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ORIGINAL RESEARCH

THE EFFECT OF KINESIO TAPE® ON STATIC FOOT POSTURE, PLANTAR PRESSURE, AND REARFOOT MOTION IN INDIVIDUALS WITH PRONATED FEET

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ABSTRACT

Background: Kinesio Tape® (KT) is an elastic therapeutic tape that is applied to the skin for treatment of sport-related injuries. Its application has been purported to facilitate the neuromuscular system, thus altering skeletal muscle activity to increase joint range of motion and improve performance. Due to its proposed therapeutic effect, KT may benefit individuals with excess foot pronation in order to decrease pain and improve function. Unfortunately, current research regarding the ability of KT to alter foot biomechanics is limited.

Purpose: The purpose of this study was to determine if the application of KT to the ankle and lower leg would alter static foot posture, plantar pressure, and foot motion during walking in individuals with foot pronation.

Study Design: Prospective Cohort Study

Methods: Thirty participants (10M/20F) were recruited for this study. Each participant had their dorsal arch height and midfoot width measured prior to the application of the KT. In addition, their dynamic rearfoot eversion and plantar pressure was recorded during walking using an electrogoniometer and plantar pressure system. After these measurements were collected, KT was applied to their right foot and lower leg in order to attempt to facilitate activity in the posterior tibialis muscle. After applying the tape, the above measurements were repeated.

Results: None of the variables measured were statistically significantly different between the pre-test and post-test.

Conclusion: Application of KT did not result in a change in static foot posture, plantar pressure, and frontal plane rearfoot motion during walking. As such, KT cannot be recommended as a treatment for reducing excessive foot pronation where such a goal would be beneficial.

Level of Evidence: Level 3

Key words: Foot Pronation, Kinesio Tape®, Walking

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INTRODUCTION

Kinesio Tape® (KT) is a therapeutic tape that is utilized in the management of various musculoskeletal clinical conditions in various settings such as athletic training, sports medicine and physical therapy.[1] KT is composed of 100% cotton, which is elastic and has an adhesive underside that is heat activated.[2] This tape is intended to mimic the qualities of human skin, as it measures about the thickness of the epidermis and it can be stretched longitudinally to 30-40% of its resting length.[3] In contrast, traditional athletic tape (such as "Coach" cloth tape) is rigid and non-elastic.[4] Because of these properties, KT also differs from other types of athletic tape in its proposed mechanism. Rather than being structurally supportive, Kinesio Tape® has -instead been purported to facilitate skeletal muscle activity through tactile and proprioceptive input, thereby improving function and/or decreasing pain.[3,5,6] The muscle most able to supinate the foot, if facilitated, would be the posterior tibialis.

Foot posture is commonly assessed clinically, and findings of either excessive pronation or supination may influence decisions about interventions such as orthotics or taping. Foot posture has been studied in terms of its influence on biomechanics during gait, as well as its relationship to specific pathologies.[7] Some studies have shown a link between foot posture and risks for certain lower limb injuries. Burns, et al. showed that there was a relationship between foot posture and overuse injuries in triathletes.[8] A 2014 systematic review by Neal, et al. reported that a pronated foot posture was associated with an increased risk for development of lower limb overuse injuries, such as medial tibial stress syndrome, Achilles tendinopathy and patellofemoral pain syndrome.[9] Because of its proposed effect, KT may be useful in modifying static foot posture in individuals with excess foot pronation.[10,11] However, despite its widespread use, the current research on the ability of KT to alter foot posture and motion is limited. In 2014, using the Foot Posture Index (FPI) to characterize the degree of foot pronation, Luque-Suarez reported that there was no change in those individuals who had their feet taped with KT.[12] In a prospective randomized double-blind study by Aguilar et al. on amateur runners, they found that the FPI was statistically reduced in both the KT and sham KT groups, but more so in the KT group. They suggested that their results indicated that KT may assist with the correction of foot posture.[3] The magnitude of the change in the FPI, however, was only +0.9.

Measurement of the pressure on the plantar surface of the foot has been used in several studies looking at the effect of KT on locomotion. Using a platform plantar pressure system, Chang and colleagues studied KT and the low-dye taping technique with white cloth athletic tape. They found an increase in peak pressure under the 5th metatarsal and reduced peak pressure under the toes using the cloth tape, but no statistical change was seen with the application of KT.[13] In 2016, two other authors reported on the effect of KT on the pressure exerted on the plantar surface of the foot during walking. Using an in-shoe plantar pressure system, Aguilar and colleagues reported a reduction in the pressure-time integral values after running for 45 minutes in both a KT and sham condition. Pressure-time integral values were found to be reduced the greatest in the sham condition. In addition, they found a decrease in the FPI for both groups with those in the KT group decreasing statistically more than those in the sham group.[3] Finally, using a platform system, Griebert and colleagues studied the effect of KT on time to peak plantar pressure during walking in those with a current or past history of medial tibial stress syndrome (MTSS). They found that time to peak plantar pressure was increased after the application of KT for those with a current or past history of MTSS.[5]

In a study by Kuni, et al., the effectiveness of KT, non-elastic tape, and soft bracing were compared in their ability to alter segmental foot kinematics during a drop landing task.[14] They found that non-elastic taping was the best stabilizer compared to KT or soft bracing, but KT was able to stabilize the rearfoot in the sagittal plane. To date, there are no published studies looking at the effect of KT on foot motion during walking.

The purpose of this study was to determine if the application of KT to the ankle and lower leg would alter static foot posture, plantar pressure, and foot motion during walking in individuals with foot pronation. The authors hypothesized that the application of KT would not increase arch height, shift plantar pressures laterally or demonstrate less calcaneus eversion during stance.

METHODS

Participants

Because of the lack of studies or insufficient detail in the published literature regarding the effect of KT on our primary variable of arch height change, an a-priori power analysis was not possible. The authors did, however look at studies that had used other types of tape to alter the height of the medial longitudinal arch[15,16] in order to perform an a-priori power analysis. The result of that analysis indicated that approximately 20 subjects would be needed to show statistical significance with an alpha and beta level of .05 and .80 respectively. Subsequently, a convenience sample of 30 participants with foot pronation (per the FPI) were recruited from a general university population to participate in this study. All participants were evaluated by a licensed physical therapist before enrolling in the study and excluded from the study if: 1) they had a history of a musculoskeletal or neuro-musculoskeletal condition that altered their ability to stand or walk normally, 2) they had a history of injury or surgery to either foot or lower extremity within the prior six months, and 3) they did not have at least 10 degrees of talocrural dorsiflexion, 20 degrees of talocrural plantarflexion and 45 degrees of first metatarsal phalangeal extension. The range of motion measurements for these screening tests were performed bilaterally in a non-weightbearing position. Because this study investigated whether KT could alter static foot posture and dynamic foot motion, participants were required to a pronated foot posture at the start of the study as indicated by the FPI. The FPI was used to ensure each subject met this criteria. The FPI involves rating six different features of the foot that are associated with either a pronated or supinated foot posture in standing. Positive values are indicative of pronation and negative values are indicative of supination. The score from the six features are then summed.[17] As such, subjects were required to have an FPI value of at least +4, which is considered "pronated".[18] The FPI has been shown to have good intra-rater reliability, moderate inter-rater reliability, and acceptable validity.[3,19] The Institutional Review Board at Northern Arizona University approved the study and all participants read and signed a written informed consent prior to participation.

Procedure

After signing the informed consent, their gender, height, and weight was recorded. Their FPI of both feet was assessed and recorded by one of the authors (MWC) using the methods described by Redmond, et al.[17]

Foot Posture. The dorsal arch height (DAH) and mid-foot width (MFW) was then measured using the methods described by McPoil, et al.[20] DAH and MFW were measured on the right foot of each participant at 50% of their overall foot length while standing relaxed using a digital caliper with a resolution of 0.01 mm (Mitutoyo America Corporation, Aurora, IL). All DAH and MFW measurements were performed by the same individual (SH). These measurements have been shown to have excellent intra-rater reliability.[21]

Foot Motion. Following the foot posture measurements, a twin axis electrogoniometer (Biometrics Ltd, Newport, UK) was affixed to the participant's right lateral ankle and leg. They were then asked to walk at their self-selected speed along a 3m walkway which included the EMED-SF plantar pressure platform (Novel Electronics Inc., St. Paul, MN). The platform has a 475 mm x 320 mm sensor area with 6,080 sensors that are sampled at 100Hz. All walking trials were observed for "targeting" of the platform and any trial in which the subject appeared to alter their walking speed or step length was repeated. During walking, the electrogoniometer measured the magnitude of the participant's frontal plane calcaneal inversion and eversion motion. The data was sampled at a rate of 100 Hz and then smoothed using a low-pass butterworth filter of 12 Hz. The mean of at least three walking trials were averaged and interpolated to represent 100% of the stance phase at each percentage point using a custom Matlab computer program (MATLAB version R2016b. Natick, MA). Using the same Matlab program, the following variables were calculated from the resulting kinematic patterns of calcaneal motion; 1) calcaneal eversion angle at heel strike (HSEVR) 2) maximum calcaneal eversion angle (MAXEVR) 3) total calcaneal eversion excursion (TOTEVR) and 4) time to maximum calcaneal eversion angle (TMAXEVR).

Plantar Pressure. The EMED-SF floor-mounted pressure platform (Novel Electronics, Inc, St Paul, Minnesota) was located at the midpoint of the 3m walkway. Plantar pressures were therefore measured simultaneously with the motion data during each walking trial. Using the "Gaitline" analysis software (Novel GmbH, Munich, Germany), the force and area medial and lateral to the resulting gait line of each participant was calculated. The following variables were calculated from the resulting plantar pressure; 1) the ratio of the difference between the medial and lateral contact areas to the total area over time (LMAI), 2) the Center of Pressure Index (COPI), which is the lateral area divided by the medial area, 3) the Lateral-Force-Time-Integral (LFTI) which is the area under the force-time curve for the lateral side of the foot, 4) the Medial-Force-Time-Integral (MFTI) which is the area under the force-time curve for the medial side of the foot, and 5) the Lateral-Medial-Force-Time-Integral-Index (LMFTII), which is an index to represent the difference between LFTI and MFTI. These variables were selected because if KT is effective, the area or force under the foot should shift laterally because of decreased pronation.

Kinesio Tape Application. At the conclusion of the walking trials, participant's right foot and lower leg were taped using a technique described by Kase, et al.[22] To ensure consistency, *Kinesio Tape® - Classic* (Kinesio USA Corporation, Albuquerque, NM) was applied to each participant by a Certified Kinesio Tape Practitioner (TJ). The tape was applied in order to facilitate the tibialis posterior muscle. For the taping procedure, each participant sat in a long-siting position on a taping table with their right ankle in neutral or zero degrees of dorsiflexion. The base of the first strip of tape was placed on the proximal third of the medial tibia with the tail terminating under the medial longitudinal arch of the foot. No tension was applied on the base and tail of the tape, while a light to moderate tension (25-50% of available length) was applied to the middle of the tape. A second Y-strip was applied to do the space correction by pulling the skin away from the medial border of the tibia (Figure 1). This was done to create additional space between the skin and superficial structures, thereby reducing pressure on the tissues.[22] The patient's foot was dorsiflexed between 5 and 10 degrees during the application of the Y-strip, with little or no tension applied at the tails of the Y to limit the tension on the skin.

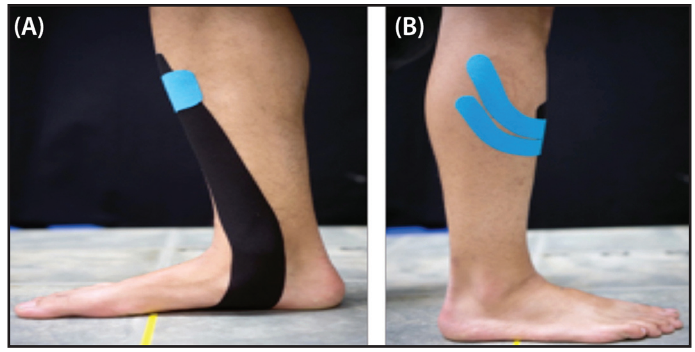

Figure 1. *Illustration of KinesioTape® Application in the current Study. A) Medial View, B) Lateral View.*

The participant then walked 10 meters along the walkway, striking the plantar pressure plate at the mid-point of the walk with their right foot. Each subject walked at least three times and the trials were averaged to obtain post-tape calcaneal motion and plantar pressure data. With the tape still applied, MFW and DAH were measured. After the second set of measures, the tape was removed and any previous markings were wiped clean with isopropyl alcohol.

Descriptive statistics (mean and standard deviation [SD]) were calculated for foot posture (DAH, MFW) and each of the dependent variables derived from the plantar pressure and motion analysis measurements. Comparison between the taped and non-taped conditions were made using paired t-tests. Because of the relatively large number of tests performed, an alpha level of 0.01 was selected to reduce the possibility of committing a Type II error. In addition, the effect size for each variable was measured using the Cohen's *d* statistic.[23] All statistical tests were performed using SPSS® software package, version 22 (IBM, Armonk, New York).

RESULTS

The demographic information for the participants who participated in this study is found in Table 1. The mean FPI for the subjects who participated in

Table 1. *Demographic characteristics of the study participants, reported as mean ± standard deviation.*

	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m^2)	Foot Posture Index
Female (n=20)	23 (2.9)	165.8 (4.4)	66.5 (11.3)	24.2 (4.02)	6.6 (2.1)
Male (n=10)	24 (2.5)	178.4 (7.1)	78.0 (14.0)	24.5 (3.93)	7.3 (2.5)
Total (n=30)	24 (5)	170.0 (8.1)	70.3 (13.2)	24.3 (3.92)	6.8 (2.2)

Table 2. *Mean (standard deviation), effect size, and power for the pre- and post-KinesioTape® condition.*

Measure	Variable	Pre-KT	Post-KT	*p*-value	Cohen's *d*	*Post-Hoc* Power
Foot posture	DAH (mm)	60.0 (5.3)	60.4 (5.3)	0.13	0.28	0.31
	MFW (mm)	81.6 (7.1)	81.0 (6.8)	0.03	0.36	0.48
Plantar pressure	LMAI	0.15 (0.06)	0.15 (0.06)	0.97	0.02	0.06
	COPI	1.37 (0.16)	1.38 (0.16)	0.93	0.13	0.10
	LFTI	217.00 (55.70)	218.22 (50.40)	0.35	0.09	0.08
	MFTI	194.28 (43.36)	196.26 (40.91)	0.16	0.25	0.26
	LMFTII	1.12 (0.11)	1.12 (0.12)	0.83	0.16	0.14
Foot motion	HSEVR (deg.)	9.73 (4.60)	9.52 (4.67)	0.57	0.099	0.08
	MAXEVR (deg.)	-1.57 (3.55)	-1.48 (3.49)	0.99	0.049	0.06
	TOTEVR (deg.)	11.08 (4.69)	11.25 (4.58)	0.96	0.073	0.07
	TMAXEVR (%)	26.62 (4.78)	26.85 (5.75)	0.77	0.057	0.06

DAH = dorsal arch height, MFW = midfoot width, LMAI = the ratio of the difference between the medial and lateral contact areas to the total area over time, COPI = the center of pressure index, LFTI = the lateral-force-time-integral, MFTI = the medial-force-time-integral, LMFTII = the lateral-medial-force-time-integral-index, HSEVR = calcaneal eversion angle at heel strike, MAXEVR = maximum calcaneal eversion angle, TOTEVR = total calcaneal eversion excursion, TMAXEVR = time to maximum calcaneal eversion angle

this study was +6.8, which is considered "pronated" and almost two standard deviations above the mean reported by Redmond et al.[18] Table 2 shows that the mean pre-tape DAH and MFW measurements for the subjects in this study was 60.0mm and 81.6mm respectively. These values are approximately two-thirds of a standard deviation below that reported by McPoil, et al in their study of normative foot posture values.[20]

Foot Posture. The results of the paired t-tests for the foot posture variables are shown in Table 2. None of the variables were statistically significantly different ($p > 0.01$) between the pre- and post-KT conditions. The Cohen's *d* statistic for DAH and MFW was 0.28 and 0.36 respectively, which is considered to be a small effect.

Foot Motion. Figure 2 shows the magnitude of frontal plane rearfoot motion during the stance phase of walking for each of the tape conditions. The results of the paired t-tests for the kinematic variables measured in this study are shown in Table 2. None of the variables were statistically significant ($p > 0.01$) between the pre- and post-KT conditions. The Cohen's *d* statistic

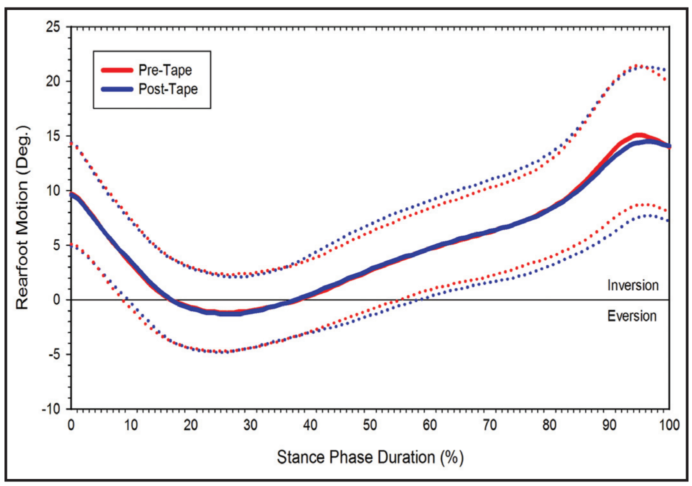

Figure 2. *Frontal Plane Motion of the rearfoot during the stance phase of walking [(solid line (mean), dashed line (+/-1 standard deviation)]*

for these four variables was small and ranged from 0.05 to 0.1 with a mean value of 0.07 (sd = 0.02). Such values are considered extremely small.

Plantar Pressure. The results of the paired t-tests for the plantar pressure measured in this study are shown in Table 2. As with the other variables measured in this study, no statistically significant differences ($p > 0.01$) were found in any of the plantar pressure measurements used in this study. The Cohen's *d* statistic for these five variables were small and ranged from 0.02 to 0.25 with a mean value of 0.13 (sd = 0.09). These values are considered small.

DISCUSSION

KT application has become a popular intervention to manage pain and skeletal muscle dysfunction. Despite the popularity, KT has not been evaluated to determine the effects on static and dynamic measures of the foot. The purpose of this study was to assess the effect of KT in participants with pronated feet with static foot posture, foot motion, and plantar pressure. The results of this study indicate that the application of KT to the foot and leg had no effect on foot posture, plantar pressure, and rearfoot motion. Post-hoc power values for the variables tested in this study are found in Table 2. The inability to detect differences between the pre- and post KT conditions may be attributable to the low power in our study. From post-hoc power analysis, the number of subjects required to have sufficient power ranged from 63 for MFW to 19,625 for LMAI. Assuming that the sample studied in the current study was representative of the population, if additional subjects were recruited, the magnitude of change observed in the variables would likely remain unchanged. For example, the mean change in MFW from the pre- to the post-KT condition was very small (0.65mm) and well below the minimum clinical difference of 1.6mm reported by McPoil, et al.[20] Adding additional subjects to increase statistical power may change the calculated effect size, but would likely not alter the magnitude of the change seen in the current study. As such, the results from the current study indicate that KT has no appreciable or clinical effect on the variables studied. The authors therefore believe that the findings of this study further support the conclusion that there is no immediate effect of the application of KT foot posture, plantar pressure, and rearfoot motion.

The outcomes of the present study agree with other recent studies that KT appears to have minimal effect on foot posture, plantar pressure and foot movement.[3,12-14] The two papers that investigated the effect of KT on foot posture used the FPI as their dependent variable, which is a fairly subjective measure and consists of categorical rather than scalar measurements. In contrast, this study used scalar measures of both DAH and MFW, but did not find a significant change after the application of KT.[3,12] The current study measured plantar pressure to assess differences in foot loading during walking as the result of the KT application. If the KT was able to facilitate activity in the posterior tibialis muscle and thus limit excess foot pronation a lateral shift in the plantar contact area or force relative to the person's gait line during walking would have been expected. However, this expected shift was not seen. These results are consistent with that reported by both Chang, et al[13] and Aguilar, et al[3] who reported no statistically significant effect of KT on plantar pressure measurements. The only study looking directly at foot motion following application of KT was conducted by Kuni, et al. who reported that KT was only able to alter rearfoot movement in the sagittal plane, but not the frontal plane.[14] The results of the current study are therefore in agreement with their study in that no effect of KT application on frontal plane rearfoot motion was found during walking. This result is also consistent with studies by other researchers who investigated whether KT was able to facilitate underlying muscle activity and found that it did not.[10,24,25] In particular, Kim et al. reported no change in the Hoffman reflex of the quadriceps muscle as a result of applying KT.[26]

There are several limitations that must be taken into account in this current study. First, the study looked only at the immediate effect of applying KT since reassessment of the dependent variables were conducted within 5-10 minutes after application of the tape. It is perhaps possible that there would have been an effect on foot posture, plantar pressure, and rearfoot motion, if the KT had remained in place for a longer time before repeating the measurements. Certainly, future research would need to be conducted to determine if this would be the case. Another limitation to the current study was that it investigated only a single method of KT application. Again, additional studies would need to be conducted looking at other methods of applying the tape in order to alter foot posture, plantar pressure, and rearfoot motion. In the current study, the tape was applied only to the right foot. Although the authors have no reason to expect that taping both feet would have altered the results of the study, such a possibility could be explored in future research. Finally, repeating the present study with a larger number of subjects would be beneficial to confirm whether the effect of KT on foot posture, plantar pressure and rearfoot motion is small and clinically irrelevant.

CONCLUSION

The results of the current study failed to demonstrate that KT statistically alters frontal plane rearfoot motion or plantar pressure during walking or static foot posture. Because the effect size on the difference between KT and no KT condition was so small, KT is not recommended to modify either foot posture or motion.

REFERENCES

1. Cai C, Au IPH, An W, Cheung RTH. Facilitatory and inhibitory effects of Kinesio tape: Fact or fad? *J Sci Med Sport*. 2016;19(2):109-112.
2. Keenan KA, Akins JS, Varnell M, et al. Kinesiology taping does not alter shoulder strength, shoulder proprioception, or scapular kinematics in healthy, physically active subjects and subjects with Subacromial Impingement Syndrome. *Phys Ther Sport*. 2017;24:60-66.
3. Aguilar MB, Abián-Vicén J, Halstead J, Gijon-Nogueron G. Effectiveness of neuromuscular taping on pronated foot posture and walking plantar pressures in amateur runners. *J Sci Med Sport*. 2016;19(4):348-353.
4. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther*. 2008;38(7):389-395.
5. Griebert MC, Needle AR, McConnell J, Kaminski TW. Lower-leg Kinesio tape reduces rate of loading in participants with medial tibial stress syndrome. *Phys Ther Sport*. 2016;18:62-67.
6. Lim ECW, Tay MGX. Kinesio taping in musculoskeletal pain and disability that lasts for more than 4 weeks: is it time to peel off the tape and throw it out with the sweat? A systematic review with meta-analysis focused on pain and also methods of tape application. *Br J Sports Med*. 2015;49(24):1558-1566.
7. Buldt AK, Levinger P, Murley GS, Menz HB, Nester CJ, Landorf KB. Foot posture is associated with kinematics of the foot during gait: A comparison of normal, planus and cavus feet. *Gait and Posture*. 2015;42(1):42-48.
8. Burns J, Keenan AM, Redmond A. Foot type and overuse injury in triathletes. *J Am Pod Med Assoc*. 2005;95(3):235-241.
9. Neal BS, Griffiths IB, Dowling GJ, et al. Foot posture as a risk factor for lower limb overuse injury: a systematic review and meta-analysis. *J Foot Ankle Res*. 2014;7(1):55-55.
10. Gómez-Soriano J, Abián-Vicén J, Aparicio-García C, et al. The effects of Kinesio taping on muscle tone in healthy subjects: A double-blind, placebo-controlled crossover trial. *Man Ther*. 2014;19(2):131-136.
11. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. *Sports Med (Auckland, NZ)*. 2012;42(2):153-164.
12. Luque-Suarez A, Gijon-Nogueron G, Baron-Lopez FJ, Labajos-Manzanares MT, Hush J, Hancock MJ. Effects of kinesiotaping on foot posture in participants with pronated foot: a quasi-randomised, double-blind study. *Physiotherapy*. 2014;100(1):36-40.
13. Chang YW, Hung W, Wu HW, Hsu HC. Effect of Non-Elastic White Tape and Kinesio Tape on Foot Pressure During Level Walking. *ISBS - Conference Proceedings Archive*. 2008;1(1).
14. Kuni B, Mussler J, Kalkum E, Schmitt H, Wolf SI. Effect of kinesiotaping, non-elastic taping and bracing on segmental foot kinematics during drop landing in healthy subjects and subjects with chronic ankle instability. *Physiotherapy.* 2016;102(3):287-293.
15. Cornwall MW, McPoil TG, Fair A. The effect of exercise and time on the height and width of the medial longitudinal arch following the modified reverse-6 and the modified augmented low-dye taping procedures. *Int J Sports Phys Ther*. 2014;9(5):635-643.
16. Vicenzino B, Franettovich MM, McPoil TG, Russell T, Skardoon G. Initial effects of anti-pronation tape on the medial longitudinal arch during walking and running * Commentary. *Br J Sports Med*. 2005;39(12):939–43–discussion943.
17. Redmond AC, Crosbie J, Ouvrier RA. Development and validation of a novel rating system for scoring

foot posture: Foot Posture Index. *Clin Biomech*. 2006;21(1):89-98.

18. Redmond AC, Crane YZ, Menz HB. Normative values for the Foot Posture Index. *J Foot Ankle Res*. 2008;1(6):1-9.
19. Cornwall MW, McPoil TG, Lebec M, Vicenzino B, Wilson J. Reliability of the modified Foot Posture Index. *J Am Pod Med Assoc*. 2008;98(1):7-13.
20. McPoil TG, Vicenzino B, Cornwall MW, Collins NJ, Warren M. Reliability and normative values for the foot mobility magnitude: a composite measure of vertical and medial-lateral mobility of the midfoot. *J Foot Ankle Res*. 2009;2(6):1-12.
21. McPoil TG, Cornwall MW, Vicenzino B, et al. Effect of using truncated versus total foot length to calculate the arch height ratio. *The Foot*. 2008;18:220-227.
22. Kase K, Wallis J, Kase T. *Clinical Therapeutic Applications of the Kinesio Taping Method*. Tokyo: Ken Ikai Co.; 2003.
23. Cohen LE. *Statistical Power Analysis for the Behavioral Sciences Second Edition*. Academic Press; 1988.
24. Fayson SD, Needle AR, Kaminski TW. The effect of ankle kinesio tape on ankle muscle activity during a drop landing. *J Sport Rehabil*. 2015;24(4):391-397.
25. Juchler I, Blasimann A, Baur H, Radlinger L. The effect of kinesio tape on neuromuscular activity of peroneus longus. *Physiother Theory Pract*. 2016;32(2):124-129.
26. Kim K-M, Davis B, Hertel J, Hart J. Effects of kinesio taping in patients with quadriceps inhibition: A randomized, single-blinded study. *Phys Ther Sport*. 2016;24:67-73.